REMARKS

After entry of this Amendment and Response, claims 85–98 and 124–129 will be pending; new claims 127–129 have been added, claims 1–11, 21–42, 55–60, 73–77, 99–105, 112, and 115–123 have been withdrawn in response to a restriction requirement and are hereby cancelled, and claims 12–20, 43–54, 61–72, 78–84, 106–111, and 113–114 have previously been cancelled. Independent claim 85, and dependent claims 125–126 have been amended. Support for the amendments and new claims may be found in the specification on, for example, page 18, line 30; page 11, lines 19–20; page 20, lines 28–30; page 21, lines 3–4; page 22, line 32; and page 25, line 27 – 26, line 2, as well as in the originally filed claims. No new matter has been added.

Rejection of claims under 35 U.S.C. § 112

Claims 125 and 126 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter the applicant regards as the invention. Claim 126 has been amended to recite that the anionic reactant is an anionically reactant starch.

Claims 125 and 126 are objected to under 35 CFR 1.75(c) as being of improper dependent form for failing to further limit the subject matter of a previous claim. Claim 86 recites that at least one of the first and second reactants is soluble in the fluid. Claims 125 and 126 recite, respectively, a second reactant that may be insoluble, i.e., a cationically or anionically reactant starch. This is not inconsistent with claim 86, on which these claims indirectly depend, that requires that only at least one of the reactants is soluble in the fluid. In each instance, the first reactant may be soluble. Thus, neither claim 125 nor claim 126 remove the requirement of claim 86.

Applicants submit that, for at least these reasons, claims 125 and 126 are in compliance with 35 U.S.C. 112 and 35 CFR 1.75(c).

Rejection of claims under 35 U.S.C. § 102(e)

Dependent claims 91, 93, 95, and 97 are rejected under 35 U.S.C. § 102(e) as allegedly being anticipated by U.S. Patent Publication No. 2001/0050031 to Bredt et al. ("Bredt '031"). Bredt '031 describes various compositions suitable for use in three dimensional printing. In some embodiments, an adhesive is present in a binder composition in combination with a fluid. *See* [0022]. The Examiner relies on Bredt '031 to teach polyethyleneimine, as recited in pending claims 91 and 95, and sulfonated polystyrene, as recited in claims 93 and 97. Bredt '031, however, does not disclose the limitations recited in independent claim 85, on which dependent claims 91, 93, 95, and 97 depend. More particularly, Bredt '031 does not disclose providing a first layer of a first particulate material comprising a first reactant and a second reactant, and allowing a reaction between the first and second reactants to occur, as recited in independent claim 85. Rather, the adhesive taught by Bredt '031 is provided in the binder composition, not in a particulate material.

Applicants submit that for at least these reasons, independent claim 85 and claims dependent therefrom are patentable over the cited art.

Rejection of claims under 35 U.S.C. § 102 (b) and 35 U.S.C. 103(a)

Claims 85–90, 92–94, 96–98, and 124–126 are rejected under 35 U.S.C. § 102(b) or in the alternative under 35 U.S.C. § 103(a) as being unpatentable over publication WO 98/09798 to Bredt et al. ("Bredt '798"). Bredt '798 appears to disclose a method for three dimensional printing that includes delivering an aqueous solvent to an adhesive particulate mixture, causing the particles of the mixture to adhere together, and to previous cross-sectional areas. The Examiner relies on Bredt '798 to teach providing first and second reactants and allowing a reaction to occur between the two reactants, as recited in independent claim 85. The Examiner asserts that the claimed first reactant reads on the adhesive, filler, or fiber of Bredt '798 and that the claimed second reactant reads on the adhesive, filler, or fiber of Bredt '798.

Bredt '798, however, does not disclose "providing ... a free-flowing particulate material comprising a first reactant and a second reactant" and "allowing a reaction between the first and second reactants to occur," as recited in independent claim 85. Rather, Bredt '798 discloses a

applying a fluid to a powder that "activates the adhesive in the mixture causing the particles to adhere together. ..." *See* Bredt '798, lines 21–22. Bredt '798 defines "activates" as to cause "a change of state from essentially inert to adhesive." *See* Bredt '798, page 8, line 29. Then, "[a]s volatile components of the fluid evaporate, the adhesive bonds harden." *See* Bredt '798, page 9, lines 8–9. The change of states, i.e., changing a powder component from a solid to a liquid and then evaporating the liquid as described by Bredt '798, is not equivalent to the reaction between two particulate components recited in independent claim 85.

Applicants submit that for at least this reason, independent claim 85 and claims dependent therefrom are patentable over the cited art.

Rejection of claims under 35 U.S.C. 103(a)

Claims 85–90, 92, 94, 96, 98, and 124–126 are rejected under 35 U.S.C. 103(a) as allegedly unpatentable over publication WO 98/51477 by Van der Geest ("Van der Geest") in view of U.S. Patent No. 4,476,190 to Clarke et al. ("Clarke") or JP Publication No. 03287683 to Hirai et al. ("Hirai") and U.S. Patent No. 5,096,491 to Nagai et al. ("Nagai"). Van der Geest appears to disclose a method for forming a shaped body by applying a layer of pulverulent material to a surface, applying at least one liquid to the layer of pulverulent material to form a layer of patternwise bound-together pulverulent material, and repeating these steps. The liquid includes water, and the pulverulent material includes at least one component that forms a binder after contact with the water. *See* abstract. An example of a powder that forms a binder after coming into contact with the liquid is wallpaper adhesive powder. *See* page 4, lines 27–30. The Examiner apparently relies on Van der Geest to teach most of the limitations of independent claim 85, but concedes that Van der Geest does not disclose a free-flowing particulate material comprising a first reactant and a second reactant. The Examiner relies on Clarke to provide this feature.

Clarke appears to disclose an adhesive for wallpaper that includes anionic and cationic polymer particles. *See* abstract. Clarke asserts that this combination of particles results in an improvement in water absorption properties, greater stability, and less of a tendency for the total

amount of adhesive in the coating to be reduced significantly during prolonged soaking. *See* column 2, lines 4–11.

Neither Van der Geest nor Clarke, alone or in combination, teaches allowing a reaction between first and second reactants to occur, the reaction causing a solidified material to form in the first region, as recited in independent claim 85. Rather, Van der Geest discloses forming a shaped body by reacting a liquid with a powder to bind the powder. *See* page 1, lines 1-14. Clarke notes that each of the polymers in the wallcovering coating will generally remain in "separate particulate form in the coating, since the particles do not form a continuous film." *See* column 4, lines 9–11. Upon wetting of the composition, some chemical interaction may occur, but Clarke does not teach the formation of a solid material because of this chemical interaction, as recited in amended independent claim 85. *See* column 4, lines 18–23. Rather, Clarke notes that the wetting of the composition results in the coating taking up water and the particles swelling and forming an adhesive coating. *See* column 4, lines 18–20. This coating "has improved water adsorption and rates of adsorption and is more stable to prolonged soaking." *See* column 4, lines 24–26. Clearly, this mechanism is not suitable for the three dimensional printing method recited in amended independent claim 85. Moreover, Clarke teaches against a reaction between cationic and anionic polymers, stating that "[i]t is essential that liquid compositions of the invention should be substantially non-aqueous in order that the two forms of polymers do not interact with one another in the liquid dispersion." *See* column 3, lines 36–40.

In addition, neither of the references, alone or combination, teaches or suggests a reaction between first and second reactants provided as components of a particulate material, such that the reaction causes a solidified material to form, as recited in claim 85.

Finally, one of skill in the art would find no motivation to use the powder of Clarke as the wallpaper adhesive powder recited by Van der Geest. The wetting of Clarke's composition results in the coating taking up water and the particles swelling and forming an adhesive coating. *See* column 4, lines 18–20. The fact that this coating has improved water adsorption and rates of adsorption implies that, if the composition were somehow used in the shaping method of Van der Geest, hardening times and shrinkage would be greatly increased. Clarke's material is highly swellable but insoluble. *See*, e.g., column 2, line 18. This property, desirable for Clarke's

application, further affirms that use of this material in the shaping method of Van der Geest would result in distortion in the formation of a shaped article.

Applicants submit that for at least these reasons, independent claim 85 and claims dependent therefrom are patentable over the cited art.

Alternatively, the Examiner relies on Hirai in combination with Nagai to teach a free-flowing particulate material comprising a first reactant and a second reactant. Hirai appears to disclose a wallpaper adhesive that includes a granular or powdery starch. *See* abstract. Nagai appears to disclose an aqueous starch slurry adhesive. *See* abstract. Nagai indicates that "[s]tarch covers, for example, raw starchs [sic]..., their modified starchs such as oxidized starch, cationic starch or anionic starch, or a mixture thereof." *See* column 2, lines 45–50. The Examiner interprets this passage as implying the starch may be a mixture of cationic and anionic starches. Applicants disagree. Nagai appears to imply that the starch may include a cationic or an anionic starch. The phrase "or a mixture thereof" appears to modify the list raw starch, modified starch, and cationic or anionic starch. Thus, a mixture may include, for example, a raw starch in combination with a cationic starch or an anionic starch. A plain reading of Nagai's definition of "starch" by a person of ordinary skill would lead that person to conclude that a mixture including a cationic starch in combination with an anionic starch is neither contemplated nor disclosed by Nagai. Furthermore, even if Nagai is interpreted as teaching a cationic starch in combination with an anionic starch, which it does not, Nagai is silent regarding any reaction between these two starches. Neither Hirai nor Nagai, alone or in combination, provides what is missing in Van der Geest and Clarke, as outlined above.

Applicants submit that for at least these reasons, independent claim 85 and claims dependent therefrom are patentable over the cited art.

Claims 85–98 and 124–126 are rejected under 35 U.S.C. § 103(a) as allegedly unpatentable over Bredt '798 in view of U.S. Patent No. 3,926,870 to Keegan et al. ("Keegan"), Nagai, or U.S. Patent No. 6,077,887 to Thuresson ("Thuresson") and optionally in view of U.S. Patent No. 5,943,235 to Earl et al. ("Earl"). The Examiner notes that Bredt '798 teaches three dimensional printing and a one component particulate material that is activated by the fluid so as

to become adhesive. As the fluid dissolves the adhesive, the fluid viscosity increases dramatically, arresting further migration of the fluid from the initial point of impact. *See* page 9, lines 2–4. The Examiner relies on Keegan or Nagai to teach a two component particulate material, as recited in independent claim 85.

Keegan appears to describe a denture adhesive that includes a mixture of a cationic polymeric material and an anionic protein material. The mixture may be formulated as a powder which, when exposed to moisture, hydrates to form an adhesive combination. *See* abstract and column 6, lines 51–55. Keegan notes that the adhesive force develops when the mixture of anhydrous cationic polymeric component and anhydrous anionic protein material is exposed to moisture. See column 2, lines 62–64. Keegan does not appear to disclose a reaction between first and second reactants, as recited in independent claim 85. Moreover, Keegan does not teach a material suitable for forming an article comprising layers, as recited in amended independent claim 85. Rather, dental adhesive powders, according to Keegan, "have the particular property of swelling to many times their original volume upon the addition of water to form a gelatinous or mucilaginous mass." *See*, column 1, lines 14–17. Furthermore, as noted above, a mixture including a cationic material in combination with an anionic material is neither contemplated nor disclosed by Nagai. Neither Keegan nor Nagai, alone or in combination, provides what is missing in Bredt '798.

In the alternative, the Examiner states that Thuresson teaches using water soluble anionic polyelectrolyte and water soluble cationic polyelectrolyte as a thickening agent so as to obtain unexpectedly high viscosity increase. The Examiner apparently relies on Thuresson to teach a two component adhesive system that may be used in the three dimensional printing method of Bredt '798. Thuresson teaches an aqueous composition, rather than a particulate material as recited in independent claim 85. Moreover, Thuresson does not teach or suggest a material that solidifies. Rather, Thuresson describes a liquid whose viscosity is greatly increased, i.e., 3-4 orders of magnitude, but which, nevertheless, remains a liquid. *See* column 5, lines 19–21. One of skill in the art would find no motivation in the references to combine the aqueous composition of Thuresson with the particulate material of Bredt '798. Even if one were to somehow combine

the teachings of the references, one would not form a solid article comprising layers, as recited in amended independent claim 85.

Optionally, the Examiner asserts that Earl is also directed to three dimensional printing and suggests using reactive material (one part epoxy or two part epoxy) in a three dimensional printing method. *See* column 5, line 40 to column 6, line 60. Earl discloses a selective deposition modeling method in which a building material is made flowable by adding to it a solvent, and then solidifying the material after dispensing, by removing the solvent. Earl does not teach or suggest a free-flowing particulate material including a first and a second reactant onto which a fluid is dispensed, as recited in independent claim 85. Earl, therefore, does not provide what is missing in Bredt '798.

Applicants submit that for at least these reasons, independent claim 85 and claims dependent therefrom are patentable over the cited art.

CONCLUSION

In light of the foregoing, Applicants respectfully submit that all claims are now in condition for allowance.

If the Examiner believes that a telephone conversation with Applicants' attorney would expedite allowance of this application, the Examiner is cordially invited to call the undersigned attorney at (617) 570-1806.

Applicants believe that no fee is due for filing of this amendment. However, if any fee is due, please charge said fee occasioned by this paper to our Deposit Account No. 07-1700.

Respectfully submitted,

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